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IS 193 (2000): Soft Solder [MTD 9: Lead, Zinc, Cadmium, Tin, Antimony and their Alloys]



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“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक

मृदु टाँका — विशिष्टि  
( पाँचवा पुनरीक्षण )

*Indian Standard*

SOFT SOLDER — SPECIFICATION  
( *Fifth Revision* )

ICS 77.120.60

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**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

## FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lead, Zinc, Cadmium, Tin, Antimony and Their Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

The solders are alloys of lead and tin (usually also contain bismuth and small amounts of some other metals) used for joining, to distinguish them from the copper base alloys used in brazing. The upper limit of melting range is about 300°C.

In this revision a new Grade Sn 15 is included for use in lamp manufacture where it is replacing more expensive grades containing higher tin content and clauses on supply of material, chemical composition, form and size and sampling have been modified.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

**AMENDMENT NO. 1 APRIL 2009  
TO  
IS 193 : 2000 SOFT SOLDER — SPECIFICATION**

**( Fifth Revision )**

(Page 1, *clause 2*) — Insert the following at the appropriate place:

‘IS 11516 : 2005 Soft solder for electronic applications (*first revision*)’.

(Page 1, *Table 1, Grade Sn 65, col 3*) — Substitute ‘0.50’ for ‘0.65’.

(Page 1, *Table 1, Grade Sn 60, col 3*) — Substitute ‘0.50’ for ‘0.60’.

(Page 1, *Table 1*) — Add the following Note at the end of the Table 1:

‘NOTE — For any other grades such as Sn 63, Sn 62, *see* IS 11516.’

(Page 2, *Table 2, Grade Sn 95 Sb 5, col 4*) — Substitute ‘0.10 Max’ for ‘0.07 Max’.

# Indian Standard

## SOFT SOLDER — SPECIFICATION

### ( Fifth Revision )

#### 1 SCOPE

This standard covers the requirements of non-antimonial and antimonial soft solders for general use, solders for use at high temperature and special applications.

#### 2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

| IS No.          | Title                                                          |
|-----------------|----------------------------------------------------------------|
| 998 : 1959      | Methods of chemical analysis of soft solder                    |
| 998             | Methods of chemical analysis of solder (soft and rosin cored): |
| (Part 1) : 1983 | Determination of tin and antimony ( <i>first revision</i> )    |

(Part 2) : 1983 Determination of iron, copper and arsenic (*first revision*)

(Part 3) : 1983 Determination of cadmium, zinc, aluminium, bismuth and nickel (*first revision*)

1387 : 1993 General requirements for the supply of metallurgical materials (*second revision*)

#### 3 SUPPLY OF MATERIAL

General requirements relating to supply of material shall conform to IS 1387.

#### 4 MANUFACTURE

Soft solder shall be made from virgin metals or clean scrap.

#### 5 CHEMICAL COMPOSITION

5.1 The material shall have the chemical composition given in Tables 1, 2 and 3. Typical uses and melting range of solders covered in Tables 1 and 2 are given in Annex A for information.

**Table 1 Tin-Lead Solders for General Use**

| Grade               | Non-Antimonial Solders, Percent |            |           |
|---------------------|---------------------------------|------------|-----------|
|                     | Sn                              | Sb         | Pb        |
|                     |                                 | <i>Max</i> |           |
| Sn 65               | 65 ± 0.5                        | 0.65       | Remainder |
| Sn 60               | 60 ± 0.5                        | 0.60       |           |
| Sn 50               | 50 ± 0.5                        | 0.50       |           |
| Sn 45               | 45 ± 0.5                        | 0.45       |           |
| Sn 40               | 40 ± 0.5                        | 0.40       |           |
| Sn 35               | 35 ± 0.5                        | 0.35       |           |
| Sn 30               | 30 ± 0.5                        | 0.30       |           |
| Sn 20               | 20 ± 0.5                        | 0.20       |           |
| Sn 15 <sup>1)</sup> | 15 ± 0.5                        | 0.20       |           |
| Grade               | Antimonial Solders, Percent     |            |           |
|                     | Sn                              | Sb         | Pb        |
| Sn 50 Sb            | 50 ± 0.5                        | 2.5-3.0    | Remainder |
| Sn 45 Sb            | 45 ± 0.5                        | 2.2-2.7    |           |
| Sn 40 Sb            | 40 ± 0.5                        | 2.0-2.4    |           |
| Sn 32 Sb            | 32 ± 0.5                        | 1.6-1.9    |           |
| Sn 30 Sb            | 30 ± 0.5                        | 1.5-1.8    |           |
| Sn 18 Sb            | 18 ± 0.5                        | 0.9-1.2    |           |
| Sn 2 Sb             | 2 ± 0.5                         | 0.2-0.5    |           |

<sup>1)</sup> This is finding increasing use in lamp manufacture where it is replacing more expensive grades containing higher tin content.

**Table 2 Solders for Service at High Temperatures**  
(Clause 5.1)

| Grade       | Percent   |                 |                 |                 |
|-------------|-----------|-----------------|-----------------|-----------------|
|             | Sn        | Sb              | Pb              | Ag              |
| Sn 95 Sb 5  | 95 ± 0.5  | 4.75-5.25       | 0.07 <i>Max</i> | 0.02 <i>Max</i> |
| Sn 5 Ag 1.5 | 4.75-5.25 | 0.10 <i>Max</i> | Remainder       | 1.4-1.6         |
| Sn 5 Ag 1.0 | 4.75-5.25 | 0.10 <i>Max</i> | Remainder       | 0.9-1.1         |
| Sn 1 Ag 1.5 | 0.75-1.25 | 0.10 <i>Max</i> | Remainder       | 1.4-1.6         |

NOTE — These solders are more difficult to use than those specified in Table 1. Advice should be sought from the supplier in the choice of solder for a particular use.

**Table 3 Solders for Special Applications**  
(Clauses 5.1 and 5.4)

| Constituent           | Grade, Percent |           |
|-----------------------|----------------|-----------|
|                       | Sn 38          | Sn 2      |
| Tin                   | 38 ± 0.5       | 2 ± 0.25  |
| Antimony, <i>Max</i>  | 0.06           | 0.06      |
| Arsenic, <i>Max</i>   | 0.015          | 0.015     |
| Iron, <i>Max</i>      | 0.02           | 0.02      |
| Aluminium, <i>Max</i> | 0.001          | 0.001     |
| Zinc, <i>Max</i>      | 0.003          | 0.003     |
| Cadmium, <i>Max</i>   | 0.005          | 0.005     |
| Nickel, <i>Max</i>    | 0.002          | 0.002     |
| Bismuth, <i>Max</i>   | 0.05           | 0.05      |
| Silver, <i>Max</i>    | 0.02           | 0.02      |
| Copper, <i>Max</i>    | 0.05           | 0.05      |
| Lead                  | Remainder      | Remainder |

**5.2** The material when analyzed by the method specified in relevant parts of IS 998 or any other established instrumental/chemical method shall conform to the requirements. In case of dispute, the procedure given in IS 998 and its relevant parts shall be the referee method. However when the method is not given in IS 998 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

### 5.3 Impurities

**5.3.1** The supplier shall undertake that the material covered in Tables 1 and 2 does not contain the following impurities in excess of the amount stated below:

| <i>Element</i> | <i>Percent, Max</i> |
|----------------|---------------------|
| Arsenic        | 0.05                |
| Iron           | 0.02                |
| Copper         | 0.05                |

#### 5.3.2 Other Impurities

The solders shall not contain impurities, such as aluminium, zinc or cadmium in amounts which

injuriously affect the properties of the solder. Solder proved to be faulty in use and found to contain these impurities shall be rejected.

**5.4** For special applications (for example can side seam soldering on high speed boidymakers) Sn 2 and Sn 38 grades as given in Table 3 of non-antimonial solders may be used.

## 6 FREEDOM FROM DEFECTS

The material shall be of uniform quality, clean and free from foreign matter.

## 7 FORM AND SIZE

Soft solder shall be supplied in one of the following forms as specified by the purchaser:

- Sticks;
- Ingots; and
- Any other form such as bars, pallets/chips, etc, the mass of which shall be as agreed to between the purchaser and the manufacturer.

## 8 SAMPLING

**8.1** Three ingots shall be selected to represent shipment of less than 450 kg, five ingots to represent 450 kg up to and including 4 500 kg, and ten ingots to represent over 4 500 kg.

**8.1.1** Saw cuts shall be made entirely across each piece at several points not more than 25 mm apart and evenly distributed throughout the length. No lubricants shall be used for sawing. Sawings thoroughly mixed shall constitute sample for chemical analysis.

**8.1.2** Samples for chemical analysis should be taken in such a way so as to represent entire cross section. No lubricant should be used for preparation of sample and sample should be thoroughly washed before chemical analysis.

## 9 RETEST

If the sample prepared under 8 fails to meet the requirements specified under 5, the same sample shall be analyzed in duplicate. If both the test results

satisfy the relevant requirements, the lot shall be accepted. Should either of the samples fail to comply with the requirements, the lot represented shall be rejected.

## 10 MARKING

**10.1** Each parcel/package of solders may be marked with the following:

- a) Cast number,
- b) Grade, and
- c) Manufacturer's initials or trade-mark.

**10.1.1** The material may also be marked with the Standard Mark.

**10.1.2** The use of the Standard Mark is governed by the provision of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made there under. The details of the conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## ANNEX A

(Clause 5.1)

Properties and Applications of Solders  
(For Information Only)

| Grade       | Melting Range |                | Typical Uses                                                                                                                                                                                                                                                                           | Characteristics                                      |
|-------------|---------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|             | Solidus<br>°C | Liquidus<br>°C |                                                                                                                                                                                                                                                                                        |                                                      |
| (1)         | (2)           | (3)            | (4)                                                                                                                                                                                                                                                                                    | (5)                                                  |
| Sn 65       | 183           | 185            | Work requiring low melting points or free running solder, for example, electrical, radio and instrument assemblies and machines soldering of can and seam                                                                                                                              | Lowest melting points of the series                  |
| Sn 60       | 183           | 188            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 50       | 183           | 212            | Coppersmith's and Tinsmith's bit soldering and general machine soldering, for example, soldering of can end seams                                                                                                                                                                      | Moderately low melting point and short melting range |
| Sn 50 Sb    | 185           | 204            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 45       | 183           | 224            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 45 Sb    | 185           | 215            | Blowpipe soldering and soldering of side-seams on high-speed body forming machines. Grade Sn 40 may also be used for electrical joints and is suitable for soldering zinc and zinc plated, galvanized or cadmium plated metals. For general soldering work, grade Sn 40 Sb may be used | High melting point and long melting range            |
| Sn 40       | 183           | 234            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 40 Sb    | 185           | 227            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 35       | 183           | 255            | Blowpipe soldering and soldering of side-seams on high-speed body forming machines                                                                                                                                                                                                     | High melting point and long melting range            |
| Sn 32 Sb    | 185           | 243            | Wiping of cable and lead pipe joints, and dipping baths and where a pasty range is required                                                                                                                                                                                            | Long melting range                                   |
| Sn 30       | 183           | 255            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 30 Sb    | 185           | 248            | Dipping solder for lamp manufacture                                                                                                                                                                                                                                                    | Long melting range                                   |
| Sn 20       | 183           | 275            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 18 Sb    | 185           | 275            | do                                                                                                                                                                                                                                                                                     | do                                                   |
| Sn 15       | 183           | 275            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 2 Sb     | 316           | 322            | Soldering of side-seams on high speed body forming machines                                                                                                                                                                                                                            | High melting point and very short plastic range      |
| Sn 95 Sb 5  | 236           | 244            | For high temperature services                                                                                                                                                                                                                                                          | —                                                    |
| Sn 5 Ag 1.5 | 296           | 310            |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 5 Ag 1.0 | 308           | —              |                                                                                                                                                                                                                                                                                        |                                                      |
| Sn 1 Ag 1.5 | 309           | —              |                                                                                                                                                                                                                                                                                        |                                                      |

## NOTES

1 Antimonial solders are not suitable for use with zinc or galvanized articles.

2 Non-antimonial solders are sometimes preferred for machine soldering of containers.

3 Joints made by soft solders specified in this standard are not generally suitable for service at temperature in excess of 140°C.

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**Amendments Issued Since Publication**

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